HIGH-TEMP. INSULATED MEASUREMENT AND CONTROL WIRES

The present utility model relates to a high-temperature resistant wire for electric equipment, which can be used as measuring and controlling wires at high temperature situations.

The commonly used high temperature resistant insulated wire has the similar structure to that disclosed in Japanese patent documents JP57-88619 and JP57-88620, which comprises coating a high temperature resistant composite insulated layer, a mixture of a high temperature resistant resin and inorganic particles, on a conductor, and is manufactured by coating a composite coating layer on the conductor and sintering for use. Such a wire is stiff and is not easy for use, has reduced insulated resistance at high temperatures, for example 0.1 MΩ at a temperature of 900°C. So it cannot be used for precise measurement. The present utility model aims at improving the insulated ability of the type of wire at high temperatures such that it has a high insulated resistance at a high temperature situation and flexibility.

For achieving the purpose, the following technical solution is adopted:

1. Weaving a homogeneous and compact insulated layer with silica glass fibres on the high temperature resistant composite insulated coating layer outside the conductor;

2. Applying another high temperature resistant composite insulated coating layer on the outside of the silica glass fibre woven layer;

3. Drying the composite coating layer to a state of semi-solid such that the wire is flexible, after the wire is laid and installed, slowly heating by the high using temperature to have the coating inorganic and form a ceramic insulated layer having a higher insulated property.

Fig 1. The structure illustration of the high temperature insulated measuring and controlling wire

Fig 1 shows a conductor (1), a high temperature resistant composite insulated coating layer (2) (hereafter referred to as the composite coating layer), and a silica glass filament woven layer (3).

The conductor (1) is a high temperature resistant metal wire or an alloy conduit selected from nickel silica wire, nickel chrome wire, stainless steel wire, gold palladium chrome wire, and pure nickel wire. The high temperature resistant composite insulated coating layer (2) is made of a coating produced by adding inorganic powders and a solvent to a silicon-type resin, wherein the silicon-type resin can be selected from silicon resin or modified silicon resin, the inorganic particles can be materials in the form of powder selected from Al_2O_3, $BaTiO_3$, SiO_2 and MgO. The coating layer is in a state of semi-hardened.

Following is the further illustration of the present invention with combination of examples:

In order to fulfill the present invention, three groups of samples of the high temperature resistant composite coating, A, B, C are formulated using silicon rubbers of different specifications together with oxidized aluminum; the compositions are given in Table 1:

Table 1:

	A	B	C
oxidized aluminum (average particle size of about 1μm)	5 to 20	5 to 20	5
Silicon rubber	100[1)]	100[2)]	100[3)]
Contacting medium			About 5
Solvent (xylene)	Suitable amount	Suitable amount	Suitable amount

Note: 1): 108 silicon rubber M:N=1:1, available from Chenguang Chemical Research Institution

2): 107 silicon rubber M:N=1:1, available from Chenguang Chemical Research Institution

3): LTV-A available from Shanghai Resin Plant

4): LTV-B available from Shanghai Resin Plant

Samples of the high temperature insulated measuring and controlling wire of different structures are manufactured on the 0.5 mm nickel chrome wire or nickel silicon wire using A, B, C three kinds of coatings with different coating structures.

The Structure of No.1, No.2 and No.3 wires is: conductor + composite coating layer + silica glass filament woven layer + composite coating layer, namely the structure of the present utility model.

The Structure of No.4, No.5 and No.6 wires is: conductor + silica glass filament woven layer + composite coating layer.

The Structure of No.7, No.8 and No.9 wires is: conductor + composite coating layer, namely the structure of the existing high temperature resistant insulated wire.

The Structure of No.10 wire is conductor + silica glass filament woven layer.

The composite coating layer of the wire is dried under a temperature between 550 and 650°C such that the silicon resin is in a state of semi-hardened, thus the wire being flexible under using situation. After the wire is laid and installed, the composite coating layer of the wire is slowly becoming inorganic under the high using temperature and becomes a ceramic insulated layer finally. No.1, No.2 and No.3 high temperature insulated measuring and controlling wires have a high temperature resistant insulated layer composed of the ceramic insulated layer outside the conductor and the ceramic insulated layer outside the silica glass fibre woven layer, and therefore, have a comparatively high insulated property.

The testing result of properties of samples of high temperature insulated wire of different structures is given in the following Table 2.

Table 2: Properties of high temperature insulated wires of different structures

No.	High temperature insulated structure				Water and oil repellent[1)]	Cold resistance[2)]
	Conductor[3)]	Coating	Woven layer	Coating		
1		A	Glass filament	A	$>10^6$ after 120 hrs	No cracking
2		B	ditto	B	ditto	ditto

3		C	ditto	C	ditto	ditto
4		/	ditto	A	ditto	ditto
5		/	ditto	B	ditto	ditto
6		/	ditto	C	ditto	ditto
7		A	/	/	10^6 after 1 hr	
8		B	/	/	ditto	
9		C	/	/	ditto	
10		/	Glass filament	/	Oil but not water repellent	

Table 2 (continued)

No.	High temperature insulated property MΩ			
	700°C	800°C	900°C	1000C
1	200 to 40	40 to 60	10 to 30	1 to 5
2	ditto	ditto	ditto	ditto
3	ditto	ditto	ditto	ditto
4			About 3	
5			ditto	
6			ditto	
7			About 0.1	
8			ditto	
9			ditto	
10	About 0.3			

Note: 1) Water and oil repellent is determined by impregnating the samples in water and oil for a time and then measuring the insulated electric resistance.

2) Cold resistance is determined by placing the samples under a

temperature of -60°C for six hours and then measuring the insulated resistance.

3) The conductor is a 0.5 mm nickel chrome wire or nickel silicon wire.

It can be seen from Table 2 that No.1, No.2 and No.3 high temperature insulated measuring and controlling wire manufactured according to the present utility model have excellent water and oil repellent and high temperature insulated property than the existing No.7, No.8 and No.9 high temperature insulated wire. The resistance of the existing high temperature insulated wire is reduced to 0.1 MΩ at a temperature of 900°C while that of the high temperature insulated measuring and controlling wire of the structure of the present utility model is above 1 MΩ when the temperature is 1000°C.

It can be seen that the examples have proved that the high temperature insulated measuring and controlling wire produced according to the present utility model is flexible, easy for use and installation, and has excellent high temperature insulated property and therefore, can be used for high precise measurement.